

# PENT COOPERATION TREATY

PCT

## **NOTIFICATION OF ELECTION**

(PCT Rule 61.2)

Date of mailing (day/month/year) 09 April 2001 (09.04.01)	Arlington, VA 22202 ETATS-UNIS D'AMERIQUE in its capacity as elected Office
International application No. PCT/GB00/02970	Applicant's or agent's file reference 8.69747/001
International filing date (day/month/year) 31 July 2000 (31.07.00)	Priority date (day/month/year) 29 July 1999 (29.07.99)
<b>Applicant</b>	
FOLLESTAD, Arild et al	

1. The designated Office is hereby notified of its election made:

in the demand filed with the International Preliminary Examining Authority on:

26 February 2001 (26.02.01)

in a notice effecting later election filed with the International Bureau on:

2. The election  was

1

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p><b>The International Bureau of WIPO</b>  <b>34, chemin des Colombettes</b>  <b>1211 Geneva 20, Switzerland</b></p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p><b>Authorized officer</b></p> <p><b>Zakaria EL KHODARY</b></p> <p>Telephone No.: (41-22) 338.83.38</p>
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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference <b>8.69747/001</b>	<b>FOR FURTHER ACTION</b> see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. <b>PCT/GB 00/02970</b>	International filing date ( <i>day/month/year</i> ) <b>31/07/2000</b>	(Earliest) Priority Date ( <i>day/month/year</i> ) <b>29/07/1999</b>
Applicant <b>MARSDEN, John Christopher et al.</b>		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.

It is also accompanied by a copy of each prior art document cited in this report.

**1. Basis of the report**

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :
- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2.  **Certain claims were found unsearchable** (See Box I).

3.  **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

**NONE**

None of the figures.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 00/02970

**A. CLASSIFICATION OF SUBJECT MATTER**  
 IPC 7 C08F10/00 C08F4/642 C08L23/16

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 C08F C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 57998 A (BOREALIS AS ;COCKBAIN JULIAN (GB); NENSETH SVEIN (NO); FOLLESTAD A) 23 December 1998 (1998-12-23) cited in the application examples 3,4 ---	1,4-11
X	WO 99 05153 A (TARGOR GMBH ;BINGEL CARSTEN (DE); FRAAIJE VOLKER (DE); KUEBER FRAN) 4 February 1999 (1999-02-04) examples 2,3 page 23, line 32 - line 44 page 24, line 13 - line 17 ---	1,4-11
X	WO 97 43323 A (DUN JOZEF J VAN ;MIYAMOTO AKIRA (JP); MATSUSHITA FUMIO (JP); CHUM) 20 November 1997 (1997-11-20) page 114; example 9; table 3 page 116; example 13; table 5 ---	14,15
-/--		

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

30 November 2000

Date of mailing of the international search report

11/12/2000

Name and mailing address of the ISA

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Authorized officer

Gamb, V

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/02970

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 528 523 A (MOBIL OIL CORP) 24 February 1993 (1993-02-24) page 11; example 6; table V ---	14, 15
X	EP 0 676 418 A (BP CHEM INT LTD) 11 October 1995 (1995-10-11) cited in the application page 9; example 14; table 2 ---	14
X	EP 0 398 350 A (IDEMITSU PETROCHEMICAL CO) 22 November 1990 (1990-11-22) page 6, line 3 - line 6 page 16; examples 11,12; table 3 ----	14
X	US 5 834 557 A (TSUTSUI TOSHIYUKI ET AL) 10 November 1998 (1998-11-10) column 41, comparative example 1 table 2 -----	14

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT/GB 00/02970

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9857998 A	23-12-1998	AU 8115798 A AU 8222398 A BR 9810154 A BR 9810157 A CN 1260807 T CN 1260804 T EP 0993478 A EP 0991676 A WO 9858001 A		04-01-1999 04-01-1999 08-08-2000 08-08-2000 19-07-2000 19-07-2000 19-04-2000 12-04-2000 23-12-1998
WO 9905153 A	04-02-1999	EP 1003757 A		31-05-2000
WO 9743323 A	20-11-1997	JP 9309926 A AU 3131997 A CA 2255754 A CZ 9803728 A EP 0898586 A HU 9902561 A NO 985329 A PL 329949 A ZA 9704269 A		02-12-1997 05-12-1997 20-11-1997 17-03-1999 03-03-1999 29-11-1999 15-01-1999 26-04-1999 16-11-1998
EP 0528523 A	24-02-1993	AU 661851 B AU 1935492 A CA 2074598 A JP 5202129 A		10-08-1995 28-01-1993 25-01-1993 10-08-1993
EP 0676418 A	11-10-1995	AT 194993 T CA 2146208 A DE 69518104 D JP 8041118 A		15-08-2000 08-10-1995 31-08-2000 13-02-1996
EP 0398350 A	22-11-1990	JP 1998352 C JP 2305811 A JP 7017710 B CA 2017183 A US 5494982 A		08-12-1995 19-12-1990 01-03-1995 19-11-1990 27-02-1996
US 5834557 A	10-11-1998	US 5708080 A CA 2103380 A EP 1050558 A EP 0605952 A JP 6207057 A KR 132728 B US 5464905 A JP 6206941 A KR 132766 B		13-01-1998 20-05-1994 08-11-2000 13-07-1994 26-07-1994 13-04-1998 07-11-1995 26-07-1994 13-04-1998

**PATENT COOPERATION TREATY**  
**PCT**  
**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

14  
REC'D 13 NOV 2001

WIPO

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**(PCT Article 36 and Rule 70)**

Applicant's or agent's file reference  8.69747/001	<b>FOR FURTHER ACTION</b>	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No.  PCT/GB00/02970	International filing date (day/month/year)  31/07/2000	Priority date (day/month/year)  29/07/1999
International Patent Classification (IPC) or national classification and IPC  C08F10/00		
<p>Applicant  BOREALIS TECHNOLOGY OY.</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 3 sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I   <input checked="" type="checkbox"/> Basis of the report</li> <li>II   <input type="checkbox"/> Priority</li> <li>III   <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV   <input type="checkbox"/> Lack of unity of invention</li> <li>V   <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI   <input type="checkbox"/> Certain documents cited</li> <li>VII   <input type="checkbox"/> Certain defects in the international application</li> <li>VIII   <input checked="" type="checkbox"/> Certain observations on the international application</li> </ul>		

Date of submission of the demand  26/02/2001	Date of completion of this report  09.11.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Adams, F  Telephone No. +49 89 2399 8511



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/02970

## I. Basis of the report

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):  
**Description, pages:**

1-32 as originally filed

**Claims, No.:**

1-18 as received on 22/10/2001 with letter of 22/10/2001

### **Drawings, sheets:**

1/8-8/8 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language(s):

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
  - the language of publication of the international application (under Rule 48.3(b)).
  - the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
  - filed together with the international application in computer readable form.
  - furnished subsequently to this Authority in written form.
  - furnished subsequently to this Authority in computer readable form.
  - The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
  - The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:  
 the claims Nos :

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB00/02970

the drawings,      sheets:

5.  This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):  
*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*
6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims
	No: Claims 1-18
Inventive step (IS)	Yes: Claims
	No: Claims 1-18
Industrial applicability (IA)	Yes: Claims 1-18
	No: Claims

2. Citations and explanations  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

Ad V:

- 1). The present application does not satisfy the requirements set forth in Article 33(2) PCT because the subject-matter of the claims 1-18 is not new in respect of prior art as defined in the regulations (Rule 64(1)-(3) PCT).

WO-A-9857998 (D1) discloses a process for the preparation of an ethylene/1-hexene copolymer under constant temperature and pressure in a single reactor in the presence of a catalyst system comprising two coimpregnated metallocene catalysts, e.g.  $(nBuCp)_2 ZrCl_2$  and  $rac-SiMe_2 (2\text{-methyl-4-phenyl-indenyl})_2 ZrCl_2$  (cf. examples 3 and 4). As long as it is not clear from the claims what is to be understood under "polymer chain defect content" this feature can not be used to distinguish the present invention from the prior art. The feature, that "said metallocenes being selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction" can also not be regarded as a limitation over the prior art as each single metallocene polymerization catalyst produces an olefin polymer comprising a higher molecular weight fraction and a lower molecular weight fraction.

- 2). The subject-matter of the present claims 1-18 is furthermore known from WO-A-9905153 (D2; cf. examples 2 and 3) and US-A-5834557 (D7; cf. preparation example 1).

The subject-matter of the present claims 13-18 is furthermore known from WO-A-9743323 (D3, cf. examples 9, 13 to 16), EP-A-0528523 (D4; cf. example 6), EP-A-0676418 (D5; cf. example 14) and EP-A-0398350 (D6; cf. examples 5-8, 11, 12). Claims 13-18 do not exclude polyolefins obtained by blending techniques and do also not exclude polyolefines obtained in a two-step polymerization process.

Ad VIII:

- 1). The term "having different propensities for incorporation of polymer chain defects" used in claim 1 is vague and unclear and leaves the reader in doubt as to the meaning of the technical feature to which it refers, thereby rendering the definition

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/02970

of the subject-matter of said claim unclear (Art. 6 PCT).

- 2). There should be a clear definition of the "polymer chain defect" in claims 1 and 13 (Art. 6 PCT).
- 3). Polymerization examples not falling under the scope of the invention using the catalysts A, B, D, F, H and I should be characterized as comparative examples (Art. 6 PCT). As none of the examples contains any information about the polymer chain defect content, it appears that there are no examples falling under the scope of the amended set of claims.
- 4). The feature "said metallocene being selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction" is, firstly an attempt to define the invention by the result to be achieved which is not allowable in claims (Art. 6 PCT). More importantly, the feature is banal as almost any polymer catalyst produces polymers of different molecular weights separable into higher and lower weight fractions.

Claims:

1. A process for the preparation of an olefin polymer which comprises effecting olefin polymerisation under essentially constant conditions in a single reactor in the presence of a catalyst system comprising a support material coimpregnated with at least two metallocene olefin polymerisation catalysts having different propensities for incorporation of polymer chain defects.
- 10 2. A process as claimed in claim 1 wherein said metallocenes are selected to produce an olefin polymer comprising at least a higher molecular weight fraction and a lower molecular weight fraction, wherein the polymer chain defect content of said higher molecular weight fraction is at least 3 times that of said lower molecular weight fraction.
- 15 3. A process as claimed in claim 2 wherein said metallocenes are selected so that the polymer chain defect content of said higher molecular weight fraction is at least 10 times that of said lower molecular weight fraction.
- 20 4. A process as claimed in any preceding claim wherein at least one of said metallocenes comprises a group 4 metal.
- 25 5. A process as claimed in claim 4 wherein the catalyst system comprises at least a first metallocene selected from rac-dimethylsilyl bis(2-methyl-4-phenylindenyl)zirconium dichloride, bis(n-butylcyclopentadienyl)hafnium dichloride, ethyl bis(1-indenyl)hafnium dichloride and rac-dimethylsilyl bis(9-fluorenyl)zirconium dichloride and a second metallocene selected from bis(pentamethylcyclopentadienyl)zirconium dichloride, bis(n-butylcyclopentadienyl)zirconium

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dichloride and dimethylsilyl bis(9-fluorenyl)zirconium dichloride.

6. A process as claimed in any preceding claim wherein  
5 the catalyst system further comprises a cocatalyst.

7. A process as claimed in claim 6 wherein said  
cocatalyst is methyl aluminoxane.

10 8. A process as claimed in any preceding claim wherein  
the support material is porous particulate silica.

9. A process as claimed in any preceding claim wherein  
ethylene or propylene is polymerised.

15 10. A process as claimed in claim 9 wherein  
polymerisation is effected in the presence of an  $\alpha$ -  
olefin comonomer containing up to 10 carbon atoms.

20 11. A process as claimed in claim 10 wherein ethylene  
is copolymerised with 1-hexene.

25 12. A process as claimed in any preceding claim wherein  
the olefin polymer is subsequently subjected to at least  
one further polymerisation reaction.

13. A process as claimed in claim 12 wherein said  
further polymerisation reaction comprises a process as  
defined in claim 1.

30 14. A polyolefin having essentially complete particle  
to particle homogeneity and comprising at least a higher  
molecular weight fraction and a lower molecular weight  
fraction, wherein the polymer chain defect content of  
35 said higher molecular weight fraction is at least 3  
times that of said lower molecular weight fraction.

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15. A polyolefin as claimed in claim 14 wherein the polymer chain defect content of said higher molecular weight fraction is at least 10 times that of said lower molecular weight fraction.

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16. A polyolefin as claimed in claim 14 or claim 15 wherein the polymer chain defects are selected from side chains and crystallinity disrupting monomer units.

10 17. A polyolefin as claimed in claim 16 wherein the polymer chain defects comprise comonomer-derived short chain branches.

15 18. A polyolefin as claimed in claim 16 or claim 17 wherein the polymer chain defects comprise long chain branches containing at least 10 monomer units.

19. A polyolefin as claimed in claim 18 wherein said long chain branches are essentially homopolymeric.